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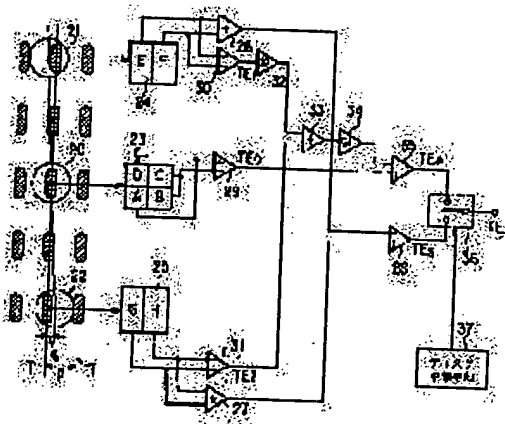   FUJIKAWA KAZUHIRO

(54) OPTICAL PICKUP DEVICE

(57)Abstract:

PURPOSE: To obtain an optical pickup device which detects tracking error signals of an optical recording medium having a $\lambda/4$ pit train and a $\lambda/8$ guide groove.
CONSTITUTION: Letting the pitch of a track T of an optical disk be 'p' in a three spot system, when the irradiated position with a main spot 20 is located at a track center, the position which is deviated for the amount of $\pm p/4$ in the track pitch direction from the track center at which the spot 20 is located, is irradiated with a pair of side spots 21 and 22, and a tracking error signal TES is detected by the detected light quantity by each of the side spots 21 and 22. Moreover, for a deform DPP system, no change is made for the positional relationship among the spots 20, 21 and 22 and a tracking error signal TEP is detected by the detected light quantities of the spots 20, 21 and 22. The signals TES and TEP are selectively outputted based on the kind of an optical disk.

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CLAIMS

[Claim(s)]

[Claim 1] The Maine spot located centering on a truck when the track pitch of this optical recording medium is set to p to an optical recording medium, The Mitsuteru gunner stage where a mutual distance irradiates the side spot of the pair which set the distance to said Maine spot as $p(2n-1)/4$ by $np/2$ (n is the natural number), A photodetection means to detect the reflected light component by said Maine spot and the side spot of said pair to each **, The 1st tracking error signal detection means which detects a tracking error signal based on the detection quantity of light in a photodetection means to detect the reflected light component by the side spot of said pair, The 2nd tracking error signal detection means which detects a tracking error signal based on the detection quantity of light in a photodetection means to detect the reflected light component by said Maine spot and the side spot of said pair, Optical pickup equipment characterized by providing an optical-recording-medium distinction means to distinguish the class of said optical recording medium, and the output signal switch means which switches the output signal of said 1st or 2nd tracking error signal detection means according to the distinction result in this optical-recording-medium distinction means.

[Claim 2] The 1st tracking error signal detection means detects a truck error signal from an added part of the sum output of two split outputs of the detection quantity of light in a photodetection means to detect the reflected light component by the side spot of said pair. The 2nd tracking error signal detection means The reflected light component by the side spot of said pair Detecting a truck error signal from difference with the differential output of two split outputs of the detection quantity of light in a photodetection means to detect the difference of the differential output of each two split output of the detection quantity of light in a photodetection means to detect, and the reflected light component by said Maine spot Optical pickup equipment according to claim 1 by which it is characterized.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the optical pickup equipment whose extract of a truck error signal was respectively enabled about the optical disk with an optical disk with lambda/4 of pit trains, and the guide rail of lambda/8.
[0002]
[Description of the Prior Art] Although the optical disk only for [, such as CD, CD-ROM, LD (laser disc), etc. which have spread widely conventionally,] playbacks has lambda/4 of pit trains, with the optical pickup equipment used for such an optical disk, 3 spot methods are adopted as a tracking servo method for detecting the truck error over an optical disk.
[0003] Drawing 3 is what shows the outline configuration of the optical pickup equipment which adopted 3 spot methods. The laser beam by which outgoing radiation was carried out from the laser diode 1 used as a laser light source is given to a diffraction grating 2. After dividing into zero-order and the primary [+] primary beam and making it a collimated beam through a polarization beam splitter 3 and a collimator lens 4, 45 degrees of plane of polarization are rotated with the quarter-wave length plate 5, and an optical disk 7 is irradiated as the Maine spot and a side spot of a pair through an objective lens 6. In this case, supposing it sets to p the pitch of the truck T formed in an optical disk 7 as shown in drawing 4 , and the Maine spot 8 is centering on a truck, as for the side spots 9 and 10 of a pair, only q (= **p/4) will irradiate the direction gap ****** of a track pitch from the truck core at which the Maine spot 8 is located.
[0004] And after letting an objective lens 6 pass, 90 degrees polarizes and it is made for 45 more degrees of plane of polarization to rotate with the quarter-wave length plate 5, and to carry out incidence to a polarization beam splitter 3 through a collimator lens 4, and to carry out incidence of the part for Mitsunari reflected from the optical disk 7 to the photodetection section 14 by this polarization beam splitter 3 through a concave lens 12 and a cylindrical lens 13.
[0005] As shown in drawing 4 , the reflected light component concerning the Maine spot 8 receives light by the quadrisection light detector 81, and he is trying for the reflected light component concerning the side spots 9 and 10 to receive light by the optical detector 91,101 here.
[0006] And after adding the signal (SA, SB, SC, and SD) according to the detection quantity of light obtained by the quadrisection light detector 81 with adders 15 and 16, respectively (SB+SD) (SA+SC), Operational amplifiers 17 and 18 are given, and a playback RF signal is outputted as (SA+SC)+ (SB+SD) from an operational amplifier 17, and focal error signal FE by the astigmatism method is outputted as (SA+SC)- (SB+SD) from an operational amplifier 18. Furthermore, output SE of the optical detector 91,101 SF An operational amplifier 19 is supplied and the tracking error signal TE is outputted as (SF-SE). And these focus error signal FE, the focus servo circuit which does not illustrate the tracking error signal TE, respectively, and a tracking servo circuit are supplied, the drive signal of a biaxial device is generated, an objective lens 6 is driven in the direction and the direction of a truck which attach and detach to an optical disk 7, and it is made to perform a focus and tracking control.

[0007] According to the optical pickup equipment which carried out the deer and adopted such 3 spot methods So that clearly also from the relation of the activation depth of a pit and the signal output which are shown in (a) of drawing 2 mentioned later About the optical disk in which the signal output relative value has lambda/4 of pit trains like CD, CD-ROM, and LD also from this by becoming max on lambda/4 of the points The modulation factor of the reflection diffraction quantity of light by the pit serves as max, and truck error detection which S/N **** was obtained and was stabilized in the truck error signal can be performed now.

[0008] By the way, with such an optical disk, although the optical disk (Write Once or Erasable disk) which enabled record playback other than the thing only for playbacks mentioned above as an optical disk is known, since continuous lambda / 4 pit trains do not exist, lambda/8 of guide rails are formed over the perimeter.

[0009]

[Problem(s) to be Solved by the Invention] However, if the optical pickup equipment which adopted 3 spot methods mentioned above be use in order to detect a truck error signal to the disk which have the guide rail of lambda/such 8, on lambda/8 of the points, the signal output relative value be that which fell considerably from the maximum point so that clearly also from the relation of the activation depth of a pit and the signal output which be show in (a) of drawing 2 . For this reason, about the optical disk which enabled record playback which has lambda/8 of guide rails, S/N of a truck error signal also had the trouble that detection could not do the truck error signal got worse and stabilized.

[0010] This invention was made in view of the above-mentioned situation, and aims at offering the optical pickup equipment which enabled detection of a truck error signal respectively best about the optical recording medium which has the optical disk of lambda/4 of pit trains, and the guide rail of lambda/8.

[0011]

[Means for Solving the Problem] The Maine spot located centering on a truck when the track pitch of this optical recording medium is set to p to an optical recording medium, The SU Mitsuteru gunner stage where a mutual distance irradiates the side spot of the pair which set the distance to said Maine spot as p (2n-1)/4 by np/2, A photodetection means to detect the reflected light component by said Maine spot and the side spot of said pair to each **, The 1st tracking error signal detection means which detects a racking error signal based on the detection quantity of light in a photodetection means to detect the reflected light component by the side spot of said pair, The 2nd tracking error signal detection means which detects a tracking error signal based on the detection quantity of light in a photodetection means to detect the reflected light component by said Maine spot and the side spot of said pair, It is constituted by a record-medium distinction means to distinguish the class of said optical recording medium, and the output signal switch means which switches the output signal of said 1st or 2nd tracking error signal detection means according to the distinction result in this record-medium distinction means.

[0012] According to this invention, moreover, the 1st tracking error signal detection means A truck error signal is detected from the difference of the cumulative output of two split outputs of the detection quantity of light in a photodetection means to detect the reflected light component by the side spot of said pair. The 2nd tracking error signal detection means The reflected light component by the side spot of said pair It is constituted so that a truck error signal may be detected from difference with the differential output of two split outputs of the detection quantity of light in a photodetection means to detect the difference of the differential output of each two split output of the detection quantity of light in a photodetection means to detect, and the reflected light component by said Maine spot.

[0013]

[Function] Consequently, according to this invention, when the track pitch of this optical recording medium is set to p to an optical recording medium, the Maine spot located centering on a truck and the side spot of the pair from which a mutual distance set the distance to the Maine spot as p(2n-1)/4 by np/2 are irradiated. And a photodetection means detects the reflected light component by these Maine spot and the side spot of a pair to each **. While detecting the racking error signal by 3 spot methods based on the detection quantity of light in a photodetection means by which the 1st tracking error signal

detection means detects the reflected light component by the side spot of a pair Based on the detection quantity of light in a photodetection means by which the 2nd tracking error signal detection means detects the reflected light component by the Maine spot and the side spot of a pair, the tracking error signal by the DPP (differential PUSHUPURU) method is detected. It is the thing it was made to output alternatively the tracking error signal by 3 spot methods or the DPP method through an output signal switch means in this condition according to the class of optical recording medium, and the truck error signal which has the modulation factor more nearly optimal than the truck error generated with 3 spot methods or a DPP method can be detected to the record medium which has a record medium with lambda/4 of pit trains, and the guide rail of lambda/8 by this.

[0014]

[Example] By the way, by 3 spot methods adopted as the optical disk only for playbacks mentioned above, detection cannot do the truck error signal which S/N of a truck error signal also got worse and was stabilized like the magneto-optic disk which enabled record playback about what formed lambda/8 of guide rails over the perimeter.

[0015] For this reason, the push pull method is conventionally considered as what detects the truck error signal of a magneto-optic disk. However, if the beam plastic surgery prism which amends horizontal and vertical ****** of a laser light source may be removed in order that it may be easy to generate offset to the shift of an objective lens, and a disk tilt compared with 3 spot methods and the thing of such a push pull method may simplify an optical pickup especially, since priority is given to a RF signal, the diameter of a spot of the direction of a truck will be enlarged to the record direction, but if it carries out like this, it will much more become easy to generate offset. Then, the DPP (differential push pull) method is considered in order to press down generating of such offset.

[0016] Although the SAPUSU pot was being used for the conventional DPP method to the Maine spot, having shifted it P/2, a subspot is used for the deformation DPP method used by this invention, shifting it P/4. It is made to enable detection of the best truck error signal because this changes 3 conventional beam methods and the method of an operation also with the optical disk with lambda/8 of guide rails, respectively as well as the optical disk with lambda/4 of pit trains.

[0017] Hereafter, one example of this invention is explained according to a drawing. In this case, since the main configuration of optical pickup equipment is the same as that of drawing 3 mentioned above, explanation here is omitted.

[0018] Drawing 1 shows the outline configuration of the exposure physical relationship of an optical spot and the photodetection section to an optical disk by optical pickup equipment. In this case, drawing 1 shows the case of the optical disk only for having-pit trains of lambda/4, such as CD, CD-ROM, and LD (laser disc), playbacks as an optical disk.

[0019] If the exposure location of the Maine spot 20 is centering on a truck when the pitch of the truck T formed in such an optical disk is set to p, as for the side spots 21 and 22 of a pair, only **p/4 will irradiate the direction gap ****** of a track pitch from the truck core at which the Maine spot 20 is located.

[0020] And the reflected light component concerning the Maine spot 20 receives light by the quadrisection light detector 23, and he is trying for the reflected light component concerning the side spots 21 and 22 to receive light by 2 division light detectors 24 and 25.

[0021] Moreover, while adding the signal (SE and SF) according to the detection quantity of light in 2 division light detector 24 which receives the side spot 21 with an adder 26 (SE+SF) The signal (SG and SH) according to the detection quantity of light in 2 division light detector 25 which receives the side spot 22 is added with an adder 27 (SG+SH). Truck error signal TES in 3 spot methods mentioned above by giving the result of these adders 26 and 27 to an operational amplifier 28, and calculating (SG+SH)-(SE+SF) He is trying to ask.

[0022] Push pull signal TE 0 according to the Maine spot 20 by, giving the signal (SA, SB, SC, and SD) according to the detection quantity of light in the quadrisection light detector 23 which receives the Maine spot 20 to an operational amplifier 29 on the other hand, and calculating (SA+SD)-(SB+SC) It asks. By moreover, the thing for which the signal (SE and SF) according to the detection quantity of

light in 2 division light detector 24 which receives the side spot 21 is given to an operational amplifier 30, and (SE-SF) is calculated Push pull signal TE 1 By giving the signal (SG and SH) according to the detection quantity of light in 2 division light detector 25 which receives the side spot 22 to an operational amplifier 31, and calculating (SG-SH), while asking Push pull signal TE 2 It asks and is the push pull signal TE 1. Amplifier 32 is minded. To an adder 33 Push pull signal TE 2 Give the direct adder 33 and these are added. Furthermore, amplifier 34 is minded for the addition result in an adder 33, and it is the above-mentioned push pull signal TE 0. An operational amplifier 35 is given and it is the truck error signal TEP in a deformation DPP method from the result of an operation here. He is trying to ask.

[0023] Here, a deformation DPP method is explained further in full detail. In this case, the amount q of gaps of the side spots 21 and 22 to the pitch p and the Maine spot 20 of the truck T formed in an optical disk (= p/4) remains as it is. Each push pull signals [TE / TE, TE /1 /, and / 2] 0 acquired from the configuration mentioned above It assumes that it is a sine wave and they are A0, A1, A2, and offset about the amplitude B0, B1, and B-2 If it carries out Push pull signals [TE / TE, TE /1 /, and / 2] 0 of each spots 20, 21, and 22 It asks below.

[0024] TE0 =A0 sin(2pix/p)+B0TE1 =A1 sin(2pi(x-q)/p)+B1TE2 =A2 sin(2pi(x+q)/p)+B-2 -- here Since offset of three spots 20, 21, and 22 is produced at same rate, the relation between B0/A0 =B1/A1 =B-2 / A2 is obtained.

[0025] And push pull signals [TE / TE and / 2] 1 of the side spots 21 and 22 Differential is taken and it is the push pull signal TE 0 of the Maine spot 20. By deducting, it is the truck error signal TEP in a deformation DPP method. It asks.

[0026] Here, since it is necessary to arrange each gain when the reinforcement of each spots 20, 21, and 22 differs, the operation of a deformation DPP method becomes like a bottom type.
TEP =TE0-G1- (G2 and TE1+TE2)
Here, the gain G1 and G2 which amplifier 34 and 32 has is G1=1/2, and A0 / A2. G2=A2 / A1, then a deformation DPP signal are TEP =A0 sin (1-cos (2piq/p)) (2pix/p).
A next door, offset B0, B1, and B-2 It is removed.

[0027] In this case, since it is q=p/4, it is TEP =A0 sin (2pix/p).
Truck error signal TEP become and according to a deformation DPP method It will be obtained.

[0028] And truck error signal TES of 3 spot methods Truck error signal TEP of a deformation DPP method It gives the change means 36. This change means 36 is based on the disk distinction result of the disk distinction means 37, and is the truck error signal TES of a change and 3 spot methods about a switch. And truck error signal TEP of a deformation DPP method He chooses either and is trying to output as truck error signal TE.

[0029] In this case, the disk distinction means 37 distinguishes the optical disk of lambda / 4 pit trains, or the optical disk of lambda/8 guide rail, and he is trying to give this distinction result to the change means 36.

[0030] What is necessary is just to detect this expression, for example in the type with which the optical disk is contained by the cartridge case, if the information on a disk class is expressed by the cartridge case in for example, the detection hole, the configuration, etc. although what adopted various methods can be considered as a disk distinction means 37 here. Moreover, after loading of the optical disk is carried out, only a focus servo is applied, and it is TEP of a deformation DPP method. TES of a signal and 3 spot methods The signal modulation factor of a signal is measured and you may make it distinguish a disk class by the size of a signal modulation factor.

[0031] Next, actuation of the example constituted in this way is explained. Now, as shown in drawing 1 , supposing the optical disk only for playbacks which has the pit train of lambda/4, such as CD, CD-ROM, and LD, is set, it will be judged with the optical disk of lambda/4 of pit trains by the disk distinction means 37 as an optical disk, and it is the truck error signal TES of 3 spot methods to the change means 36. It directs to choose.

[0032] As shown in drawing 3 from this condition, if a laser beam is irradiated from the laser diode 1 used as a laser light source, after being divided into zero-order and the primary [+] primary beam by the

diffraction grating 2 and becoming a collimated beam through a polarization beam splitter 3 and a collimator lens 4, this laser beam will rotate 45 degrees of plane of polarization with the quarter-wave length plate 5, and will be irradiated by the optical disk as the Maine spot 20 and side spots 21 and 22 of a pair through an objective lens 6.

[0033] In this case, if the Maine spot 20 is centering on a truck when the pitch of the truck T formed in an optical disk is set to p, as shown in <u>drawing 1</u>, as for the side spots 21 and 22 of a pair, only **p/4 will irradiate the direction gap ****** of a track pitch from the truck core at which the Maine spot 20 is located.

[0034] And after the amount of [which was reflected from the optical disk] Mitsunari lets an objective lens 6 pass, with the quarter-wave length plate 5, 45 more degrees of plane of polarization rotate, through a collimator lens 4, it polarizes 90 degrees and incidence is carried out to the photodetection section 14 by the polarization beam splitter 3 through a concave lens 12 and a cylindrical lens 13.

[0035] In this case, the reflected light component from the Maine spot 20 is received by the quadrisection light detector 23, and the reflected light component from the side spots 21 and 22 is received by 2 division light detectors 24 and 25.

[0036] By this the signal (SE and SF) according to the detection quantity of light in 2 division light detector 24 which received the side spot 21 The signal (SG and SH) according to the detection quantity of light in 2 division light detector 25 which was added with the adder 26 (SE+SF) and received the side spot 22 When it is added with an adder 27 (SG+SH), the result of these adders 26 and 27 is given to an operational amplifier 28 and (SG+SH)- (SE+SF) calculates Truck error signal TES in 3 spot methods It will ask and this will be outputted as truck error signal TE through the change means 36.

[0037] In this case, since a signal output relative value serves as max on lambda/4 of the points as the relation of the activation depth of the pit in 3 spot methods and the signal output to the optical disk of lambda/4 of pit trains is shown in (a) of <u>drawing 2</u>, while the modulation factor of the reflection diffraction quantity of light by the pit serves as max and S/N **** is obtained in a truck error signal, stable truck error detection can be performed.

[0038] Next, it is judged with the optical disk which has lambda/8 of guide rails with the disk distinction means 37 supposing the optical disk which formed the guide rail of lambda/8 like the magneto-optic disk which enabled record playback as an optical disk over the perimeter is set, and is the truck error signal TEP of a deformation DPP method to the change means 36. It directs to choose.

[0039] If a laser beam is irradiated from the laser diode 1 used as a laser light source as shown in <u>drawing 3</u> also in this case When the pitch of the truck T which an optical disk irradiates as the Maine spot 20 and side spots 21 and 22 of a pair, and is formed in an optical disk is set to p, If the Maine spot 20 is centering on a truck, as for the side spots 21 and 22 of a pair, only **p/4 will irradiate the direction gap ****** of a track pitch from the truck core at which the Maine spot 20 is located.

[0040] And the reflected light component from the Maine spot 20 is received by the quadrisection light detector 23, and the reflected light component from the side spots 21 and 22 is received by 2 division light detectors 24 and 25.

[0041] the signal (SA --) according to the detection quantity of light in the quadrisection light detector 23 which received the Maine spot 20 by this SB, SC, and SD are given to an operational amplifier 29, and (SA+SD)- (SB+SC) calculates. Push pull signal TE 0 by the Maine spot 20 It asks. Again The signal (SE and SF) according to the detection quantity of light in 2 division light detector 24 which received the side spot 21 is given to an operational amplifier 30. (SE-SF) calculates -- having -- push pull signal TE 1 it asks -- both The signal (SG and SH) according to the detection quantity of light in the light-receiving **** 2 division light detector 25 is given to an operational amplifier 30, (SG-SH) calculates the side spot 22, and it is the push pull signal TE 2. It asks. And push pull signal TE 1 Amplifier 32 is minded. To an adder 33 Push pull signal TE 2 The direct adder 33 is given, these are added, the addition result in an adder 33 minds amplifier 34 further, and it is the above-mentioned push pull signal TE 0. When an operational amplifier 35 is given, by ** Truck error signal TES in the result of an operation here to a deformation DPP method It will ask and this will be outputted as truck error signal TE through the change means 36.

[0042] In this case, since the relation of the activation depth in a deformation DPP method and the signal output to an optical disk with lambda/8 of guide rails comes to be shown in (b) of <u>drawing 2</u> and a signal output relative value serves as max on lambda/8 of the points, while being able to obtain a truck error signal with sufficient S/N, stable truck error detection can be performed.

[0043] therefore, if it does in this way, by 3 spot methods adopted as detection of the truck error signal of the optical disk only for playbacks If the exposure location of the Maine spot 20 is centering on a truck when the pitch of the truck T of an optical disk is set to p Only **p/4 irradiates the direction gap ****** of a track pitch from the truck core at which the Maine spot 20 is located by the side spots 21 and 22 of a pair. It is based on the detection quantity of light by each side spots 21 and 22 at this time, and is the truck error signal TES. It detects. Also about a deformation DPP method The physical relationship of the above-mentioned Maine spot 20 on an optical disk and each side spots 21 and 22 is left as it is. The detection quantity of light from these Maine spot 20 and the side spots 21 and 22 to truck error signal TEP Detection is made possible. Truck error signal TES by these 3 spot methods And truck error signal TEP by the DPP method Since it enabled it to output alternatively according to the class of actually used optical disk In the optical disk which has lambda/4 of pit trains like the optical disk only for playbacks, the best truck error signal excellent in S/N which has the optimal modulation factor also about the optical disk which, of course, has the guide rail of lambda/8 in which an account rec/play student is possible can be detected.

[0044] In addition, this invention is not limited only to the above-mentioned example, but it is the range which does not change a summary, and is ******(ed) suitably and can be carried out. Although CD of the same configuration as the conventional thing, CD-ROM, and ** (Write Once) optical pickup equipment were used for the optical pickup equipment of the example mentioned above, it is applicable to various optical pickup equipments, such as what used the hologram component for the optical pickup for optical MAG which does not take the configuration of the isolation by lambda/4 plate and the polarization beam splitter as other things, or the diffraction means. Moreover, the arrangement of the side spots 21 and 22 was 4 pitch ** carried out [**1 /] to the Maine spot 20 is not limited to this, either, and the distance between two side spots 21 and 22 is n/2 pitch (n: natural number), and the distance of the Maine spot 20 and the side spots 21 and 22 should just be (2n-1) / 4 pitch.

[0045]

[Effect of the Invention] Since the tracking error signal by 3 spot methods or the DPP method can be alternatively outputted according to the class of record medium according to this invention as stated above, it is detectable as a truck error signal which has the modulation factor more nearly optimal than the truck error generated with 3 spot methods or a DPP method also about a record medium with a record medium with lambda/4 of pit trains, or the guide rail of lambda/8.

[0046] Moreover, since offset cannot generate any truck error signal now easily to the shift of a disk tilt and an objective lens, accurate tracking becomes possible.

[Translation done.]